WASHINGTON
SCIENCE TRENDS

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* MILITARY COMMUNICATIONS

Here are the views of Maj. Gen. James A. Dreyfus, Director of Communications-Electronics for the Joint Chiefs of Staff at the Pentagon on some "critical" problems which lie ahead in this field:

✓ Communications functions must be further combined to reduce cost and increase efficiency.

✓ Reliability must be greatly improved. Circuit interruptions must not disrupt communications.

✓ Message handling and processing must be speeded up through automation.

✓ More computers will be required to reduce large quantities of data to essential information. This information must be so displayed and presented that the commander can make quick, sound decisions.

✓ System capacity must be increased many-fold to meet the requirements of new weapons systems.

* COAST AND GEODETIC SURVEY REORGANIZES

U. S. Coast and Geodetic Survey, oldest scientific bureau in the government, is reorganizing to place increasing emphasis on new technology.

New offices announced by Admiral H. Arnold Karo, Director, are:

✓ Office of Research and Development will work with scientists in government, universities and research institutions and private industry by prosecuting basic research in the earth science fields of the Survey's work and coordinating and assisting in applied research and development. The Office "is expected to become the focal point for gathering and disseminating up-to-the-minute information on scientific research activities in the fields of oceanography, geodesy, geophysics, photogrammetry and cartography."

✓ Office of Oceanography will be responsible for a comprehensive program of oceanographic surveys and a broad complex of related programs related to the sea as one of man's major environmental elements. This Office will comprise all technical oceanographic activities and all supporting facilities for such activities. It is described as "the framework upon which will be built an expanded program in the field of oceanography which is planned for the next ten years."

The reorganization is expected to provide a new source of contract opportunities in instrumentation for detection of nuclear tests, and for studies of the ocean environment.

* ELECTRONIC MICROMINIATURIZATION

Rapid progress is being made in educational, governmental and industrial laboratories in so-called "microminiaturization." A summary of developments and problems in this field published by the Diamond Ordnance Fuze Laboratories, U. S. Army Ordnance Corps, Washington 25, D. C. points out:

✓ Microminiaturization can put more complex systems in the same space now occupied by conventional systems.

✓ Redundant systems can be considered as a means of achieving greater reliability and increased resistance to countermeasures.

✓ Complete electronic systems can be incorporated in devices too small for present-day component parts.

All techniques now under development, according to Norman J. Doctor of the Army laboratory staff, offer promise of reduced size and weight; increased strength and rigidity; increased reliability directly attributable to the smallness of the structure and improved maintainability because of the "throw-away" module concept.

ø Analysis of Current Fabrication Techniques summarized from the Army study:

✓ Welding to form self-supporting structures uses commercially available parts which are connected to each other by welding their leads to metal ribbons. This forms self-supporting, 3-dimensional structures which are then encapsulated in plastic.

✓ Mounting Miniature Parts on Miniature boards, is termed the "hearing aid" approach by DOFL since it uses "hearing-aid" size parts which are soldered to miniature etched wiring boards less than 0.035 inches thick.

✓ Riser-Wire Connecting of Wafer Microelements is the micromodule approach, representing the largest current effort in the microminiaturization field. Size reduction is accomplished through more efficient uses of space made possible by fabrication of all parts in a neatly "stackable" geometry.

✓ Printing on single ceramic substrates is already available commercially. One approach involves the uses of a ceramic substrate bearing printed wiring, printed resistors and soldered-on capacitor wafers, diodes and transistors, with a complete assembly placed in a hermetically sealed can. Interconnections are achieved by soldering the leadout wires.

✓ DOFL has its own "2D" approach using printed wiring, printed resistors and wafer-thin capacitors. Both case and header are eliminated by incorporating tiny transistor and diode dice into the substrate. Vacuum deposited metals are used to connect the electrodes of the transistor and diode and the printed wiring. Capacitors and leadout wires are attached with conductive silver-filled-epoxy adhesive. The wafer circuits can be interconnected into more complex equipment by either welding the wafer leadout wires to each other, or by employing metal films deposited on the face of the encapsulated assembly.

✓ Thin film techniques are also under development, eliminating all organic materials, since narrower dimensional tolerances can be maintained on metal films than on screened or printed organic inks. Vacuum-deposited gold conductors and nickel-chromium-alloy resistors have been used. A promising development is said to be the sputtering of tantalum, which serves as a resistance film, and also may be anodized to form a capacitor dielectric.

* Electronic Microminiaturization (Continued)

✓ Solid circuit techniques are of two major types. The integrated system uses a single-crystal semiconductor material only a few mils in thickness to serve as a passive as well as an active component. The entire circuit is formed by alloying, diffusion, deposition and etching. Functional solid circuits emphasize circuit redesign. Specialized phenomena associated with multiple junction semiconductor devices are used to achieve the same input-output relationship that would otherwise be achieved with a number of individual parts. It is suggested that a carefully planned program in this field would have to include basic and applied research in multilayer semiconducting bodies.

ø Size Reduction, DOFL points out, can become something of a "numbers game" and can lead to a wide variety of parts-densities figures, depending upon what basis is used for calculations.

It is indicated, however, that programs in progress generally fall into three areas of miniaturization:

✓ Welded assemblies, "hearing aid" assemblies, micromodules and printing on single ceramic substrates represent a 10-fold size reduction over standard production techniques.

✓ DOFL-2D and thin-film circuit techniques yield a 100-fold size reduction.

✓ Solid circuit techniques promise a 1000-fold size reduction.

ø Interconnection, is still a major problem as assemblies become smaller and smaller. Programs "will fail" if they fail to produce workable schemes for interconnection, it is stated.

(A more detailed summary, suggesting advantages and disadvantages of these various techniques is now available. Write OTS, U. S. Department of Commerce, Washington 25, D. C. for PB 161 674, "Status of Microminiaturization." 29 Pages. 75 cents.)

* ENERGY CONVERSION RESEARCH

Advanced Research Projects Agency (ARPA) of the Department of Defense has won out in Pentagon attempts to control basic research in advanced energy conversion techniques. The program will be known as Project Lorraine, will be headed by Dr. Uhner Liddel of ARPA's special projects branch, and will involve annual expenditures in the neighborhood of $5 million.

Project Lorraine is, according to the Department, "designed to stimulate the flow of fundamental knowledge of the conversion of energy into useful power sources, and to support selected research in this field." An example given is the direct conversion of heat into electrical power without the use of conventional turbine machinery.

"All ideas" that have a potential in the conversion of chemical, nuclear and solar energy into power will be scrutinized by ARPA, with the intention of filling "gaps" in current programs.

The project would presumably place another layer of administrative and technical control over government laboratories which have already developed programs in these fields, as well as their contractors and subcontractors. This would be in line with other steps toward centralization of research authority under Dr. Herbert York, Director of Defense Research and Engineering -- who has control over ARPA.

TECHNICAL TRENDS

Contract price for development of the Rocketdyne 1½ million pound thrust engine is now expected to reach $110 million, with an estimated completion date of mid-1963. Original cost was expected to be $102 million, with completion in January, 1963. Officials of the National Aeronautics and Space Administration attribute this to a shortage of funds last year, and the steel strike, as well as some $3 million in newly-added special equipment items. Total costs do not include $20 million in Government-furnished propellants or liquid oxygen from Air Force plants, said to cost "considerably less" than supplies from commercial sources. This plan might be another example of criticism that NASA too often refuses to do business with private business.

Atomic Energy Commission, often faced with similar charges, reaffirms its policy of performing neutron irradiation services for commercial firms and private institutions "only if privately-owned facilities are not reasonably available." Such services are used for radioisotope production, testing of materials and other fields. Eventually, the commission says, it would like to reduce and eliminate its sales and services in fields where industrial sources become reasonable and available... Navy Bureau of Ships is interested in methods for the conversion of ocean wave motion to electrical energy. Such devices would be installed in standard whistle buoys now in service, and will be studied by Thiokol Chemical Corp. under a $79,300 contract.

Non-rigid transparent plastic film which can be sown and will resist temperatures from -65° to 180° F are of interest to the Army. For details write Commanding General, U. S. Army Ordnance Tank-Automotive Command, 1501 Beard, Detroit 9, Mich. Mark your inquiry for the Attention of ORDMC-Res. 1, Mr. J. Lyons... Aerojet-General Corp., Downey, Calif. has received a $698,433 from the Air Force for an R&D study of anti-ICBM warhead design criteria...

Second attempt to place a 100-foot inflatable sphere into a 1000 mile orbit for Project Echo communications relay program is scheduled for August 9... Battelle Memorial Institute will conduct a $65,028 study for the Bureau of Naval Weapons of the welding characteristics of heavy titanium alloy plate. Ductile uniform welds in two-inch thick plates is a major goal... Northrop Corp. has received a $950,000 contract from Wright Air Development Division, U. S. Air Force for continued research in low drag boundary layer control, including conversion of the boundary layer into additional thrust to improve engine efficiency.

National Aeronautics and Space Administration will negotiate six-month, $100,000 paper studies by Lockheed Aircraft and the Martin Co. on requirements of a nuclear rocket flight test program... Engineering schools spent $71 million for "earmarked" or sponsored research and development in Fiscal 1958, according to National Science Foundation statistics. Some $48.6 million came from the Federal Government and $10.3 million from industry... Recent Soviet tactics have increased pressure on the Pentagon to speed development of strategic satellite warning and observation systems as well as high-altitude, jet-powered drones... Navy has decided to use a new "high dispersant" oil in all of its reciprocating aircraft engines. The oil prevents formation of sludge or hard carbon and slowly dissolves old deposits until the engine is clean. Ethyl Corp. is developing exact specifications so that oil from various refiners will be compatible.

ROYALTY-FREE PATENT CHECKLIST

Here is a new listing of Government-owned patents now available for use by industry on a royalty-free basis. Subscribers desiring further information may write Service Department, Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D. C.
You will be furnished with the patent number and information on where to obtain a copy of the patent, and where to apply for licensing.

( ) FOUR QUADRANT COMPUTER: This analog computer permits four quadrant multiplication and is said to be accurate within one percent per operation. No vacuum tubes are used, only magnetic amplifiers, metallic rectifiers and precision resistors.

( ) ROTARY LOCKING DEVICE: This device is designed to be applied to a rotary switch or poteniometer to prevent accidental rotation.

( ) ANTENNA FEED SYSTEM: This device is described as an improved horn feed which produces a pencil beam free from distortion. It can be used with a parabolic reflector with a reduced focal length to diameter ratio.

( ) MISSILE COMPONENT PACKAGING: This patent covers a system for packaging fragile missile components in suspension to resist in-transit vibration and shock. It incorporates preloaded springs of fiberglass reinforced plastic.

( ) ELECTRONIC MULTIPLIER CIRCUIT: The multiplier in this patent includes a multi-element vacuum tube receiving two voltage signals. Tube output is proportional to this input.

( ) CHATTER-FREE CHECK VALVE: This valve is used in the power plant of a rocket aircraft to control the flow of high pressure, high temperature fluids such as water and alcohol.

( ) MINIATURE RADAR: This assembly consists of a drawer-shaped chassis, with an interior partition forming hollow compartments. Each compartment takes a radar sub-assembly which has a number of spring finger contacts on one side.

( ) ELECTRICAL CAMERA CLUTCH: This patent covers a clutch used in conjunction with the shutter-operating and film-transporting mechanism of an aerial camera.

( ) ADJUSTABLE EQUIPMENT PEDESTAL: This vertically adjustable tripod type of support can be used in conjunction with a surveyor's transit, a radar antenna, gun or similar types of equipment.

PUBLICATION CHECKLIST

( ) OFFICE, COMPUTING AND ACCOUNTING MACHINES, an official survey showing that manufacturers' shipments of these devices amounted to $830 million in 1959. Includes other statistical information. 3 Pages. 10 Cents. (Write Bureau of the Census, Washington 25, D. C. for Current Industrial Report Series M35R-09)

( ) RADIOISOTOPE TRAINING COURSE, a technical training program prepared by the General Motors Institute on the applications of radioisotopes to industrial work. Consists of a compilation of training material, most of which is in the form of a series of teaching objectives, each followed by pertinent technical material. Two Volumes, total of 1,500 pages. $10. (Write OTS, U. S. Department of Commerce, Washington 25, D. C.)

( ) U. S. GOVERNMENT PURCHASING, SPECIFICATIONS AND SALES DIRECTORY, a revised and expanded version of former publications providing information on selling to or buying from the U. S. Government; basic information on specifications applying to Federal contracts and a new section on Government property sales. 116 Pages. 60 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C.)

( ) RECENT RESEARCH ON CONTROLLED THERMONUCLEAR FUSION, includes review of developments at the University of California, Princeton and Oak Ridge. 80 Pages. $1. (Write Publication Sales Unit, International Atomic Energy Agency, Kaerntnerring 11, Vienna 1, Austria)

( ) NUCLEAR ENERGY BIBLIOGRAPHIES, this is Vol. I, No. 1 of a list of bibliographies on nuclear energy including those recently published, in preparation or planned. Single Copies Free. (Write Publication Sales Unit, International Atomic Energy Agency, Kaerntnerring 11, Vienna 1, Austria)

( ) THORIUM SPECTRA, a monograph presenting the wavelengths and estimated intensities in electrodeless lamp and spark sources. The tables are expected to meet all present requirements for spectrochemistry and for an extension of the structural analysis of thorium I and II. 103 Pages. 65 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for NBS Monograph 17)

( ) PRACTICAL VALUES OF SPACE EXPLORATION, an interesting congressional staff study designed to tell the taxpayer "just why so many dollars are going into the American effort to explore space." 54 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for "The Practical Values of Space Exploration")

( ) GOVERNMENT SECRECY, a blistering report from the Congressional group which has been keeping track of Government classification and secrecy policies with emphasis on Defense Department abuses. 222 Pages. Single Copies Free. (Write Committee on Government Operations, U. S. House of Representatives, Washington 25, D. C. for House Report No. 2084)

( ) BASTNASITE, a discussion of development of suitable methods for separating and purifying bastnasite rare earth elements. Discusses chemical, ion exchange and solvent extraction techniques. 20 Pages. Single Copies Free. (Write Publications-Distribution Section, U. S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Report of Investigation No. 5599)